

TAXONOMIC NOTES ON SPIRANTHES CASEI
CATLING & CRUISE AND
SPIRANTHES × INTERMEDIA AMES

PAUL M. CATLING

Only recently described, *Spiranthes casei* Catling & Cruise (1974) was previously confused with other sympatric species of *Spiranthes*, and when recognized as being distinct, it had been referred to *S. vernalis* Engelm. & Gray (Mousley, 1941, 1942; Correll, 1950; Whiting & Catling, 1971). Shortly after *S. casei* had been formally described, Luer (1975, p. 108) referred it to the previously described *S. × intermedia* Ames (1903) assigning to it a true specific status. It was briefly explained in the description of *S. casei* (Catling & Cruise, *loc. cit.*) that the name *S. intermedia* could not apply to the newly discovered species. Since Luer's interpretation occurs in a major and very recent reference work on North American orchids that actually postdates the description of *S. casei*, it is not surprising that I have received a considerable number of requests for an explanation concerning the correct choice of name. The purpose of this paper is to demonstrate that the specific epithet "*intermedia*" applies to a northeastern coastal plain complex probably involving both *S. vernalis* and *S. lacera* (Raf.) Raf. var. *gracilis* (Bigelow) Luer, and that it does not apply to the more northern taxon recently described as *S. casei*. It should be emphasized that *Spiranthes* is a taxonomically problematic genus in North America, and in the absence of a critical review of the literature, thorough morphological, ecological and distributional study, and especially, reference to the type specimens, one is unlikely to treat the genus without error.

METHODS

In the following paragraphs I have included a review of the relevant literature, and presented data collected from type material personally examined, and from specimens borrowed from various herbaria throughout the northeast (ACAD, AMES, CAN, CM, DAO, MICH, MTMG, NEBC, NFLD, PENN, PH, QUC, TRT, US, WIS). The type material of the taxa in question display an abundance of flowers, and a few could be removed without seriously affecting the specimens. Dried flowers were reconstituted with dilute ammonium

hydroxide and warm soap solution, and camera lucida drawings were prepared. The dissected flowers were later mounted on slides with glycerin and placed in the collections of the Ames Orchid Herbarium at Harvard University. Scatter diagrams are based on about 100 randomly selected herbarium sheets of each taxon from throughout its area of distribution in the northeast, with no more than two plots per locality.

TAXONOMY

Spiranthes \times *intermedia* Ames (1903) was originally described as a putative hybrid involving *S. praecox* (Walter) S. Watson and *S. gracilis* (Bigelow) Beck (= *S. lacera* var. *gracilis*). A year later the erroneously identified *S. praecox* of New England was described as a new species, *S. neglecta* Ames (Ames, 1904). Therefore *S.* \times *intermedia* became the hybrid of *S. neglecta* (= *S. vernalis*) and *S. gracilis* (Ames, 1904, p. 28). St. John (1918) discussed the hybrid complex in southeastern Massachusetts, referring to the hybrids of *S. vernalis* and *S. cernua* (L.) Rich. as *S.* \times *intermedia*. *Spiranthes cernua* \times *S. gracilis* Ames was described in 1921, and at that time Ames considered *S. neglecta* to be synonymous with *S. vernalis* (Ames 1921, p. 81). He postulated *S.* \times *intermedia* to be, "one of the variants of a cross between *S. cernua* and *S. gracilis* in which the characters of *S. gracilis* are clearly predominant" (Ames, *loc. cit.*). In 1924 Ames included *S.* \times *intermedia*, *S. neglecta* and *S. cernua* \times *S. gracilis* in synonymy with his \times *S. vernalis*.

Drawings accompanied the descriptions of *Spiranthes* \times *intermedia* (Ames, 1903, *pl.* 47), *S. neglecta* (Ames, 1904, p. 29, *fig.* 1), and *S. cernua* \times *S. gracilis* (Ames, 1921, *pl.* 128). The drawings accompanying the description of *S. cernua* \times *S. gracilis* were later used in Correll's "Native Orchids of North America" (1950), to illustrate *S. vernalis*. Although Correll placed both *S.* \times *intermedia* and *S. neglecta* in synonymy with *S. vernalis* it was not indicated that *S. cernua* \times *S. gracilis* was also a synonym despite his use of the plate.

Although the early literature treated *Spiranthes* \times *intermedia* as a hybrid involving either *S. vernalis* and *S. lacera* var. *gracilis*, or *S. vernalis* and *S. cernua*, or *S. cernua* and *S. lacera* var. *gracilis*, it was never considered a true species. It is clear that New England taxonomists had difficulty with a complex of plants likely involving *S.*

vernalis and *S. lacera* var. *gracilis*, and perhaps also *S. cernua*; but the important point is that both Ames and Correll finally admitted the confusing plants (*S. × intermedia* etc.) within the variation of *S. vernalis*, and Ames at least had studied the group in great detail.

Another clue relating to the inappropriateness of applying the name "*intermedia*" to a taxon clearly distinct from the *Spiranthes vernalis* complex can be obtained from the earlier literature. In his original description of *S. × intermedia*, Ames (1903) stated, "The coloring of lip was distinctive; yellow-green at the apical, greenish near the proximal end; the callosities or nipples were green at their base with a whitish apex." Ames (1903, p. 262) further writes, "As far as observed the color of the callosities was decisive in the determination of the hybrids." Later St. John (1918, p. 112) described the lip of *S. × intermedia* from Dover, Massachusetts, "It has a suffusion of yellowish-green color down its centre and in the callosities, suggestive of the deep green color of the body of the lip of *S. gracilis*." Although I have critically observed flower color of *S. casei* in Ontario, Quebec, New England, and the Canadian Maritimes, I have never found a specimen with yellowish-green coloration in the lip.

It was noted in the type description (Catling and Cruise, 1974) that *Spiranthes vernalis*, and also *S. × intermedia*, *S. neglecta* and *S. cernua × S. gracilis* differed from *S. casei* "in exhibiting a light-colored and frequently more dense, non-glandular pubescence on the rachis, and a denser, less robust spike with a larger number of narrower and slightly longer flowers." With the exception of the pubescence these characteristics are clear from the plate of *S. × intermedia* provided by Ames (Ames, 1903, pl. 47). In addition, it was pointed out that *S. casei* and *S. vernalis* each have discrete distributions.

Luer (1975) recognized the northern taxon as quite distinct from the southern *Spiranthes vernalis* and assumed that the description and illustration of *S. × intermedia* were applicable to it, and that its distribution ranged into southeastern Massachusetts (the type locality of *S. × intermedia*). The basis of these assumptions remains a mystery to me. Although the range of *S. casei* has been extended in the east and west since it was described, there are no new distribution records for areas substantially to the south of the range previously indicated (Catling and Cruise, 1974, p. 534). *Spiranthes*

casei (*S. intermedia* Ames *sensu* Luer) remains unknown from southeastern Massachusetts.

As previously mentioned, when *Spiranthes casei* was first recognized as distinct from other sympatric species of the genus, it was referred to *S. vernalis*. The late recognition of *S. casei* must certainly have resulted from northern botanists' lack of familiarity with the southern *S. vernalis* and a lack of familiarity on the part of the botanists further south with the distinct northern taxon (now *S. casei*). In addition there may have been a fear of complicating the group further with the publication of new names which may only represent local extremes of variation, obscure hybrids, or freaks. Thus when Henry Mousley sent his Quebec specimens to Correll, Correll referred them to *S. vernalis*; both Mousley (1941, 1942) and Correll (1950) published the Quebec occurrence under the name "*S. vernalis*". It is surprising to find that the distribution map of *S. vernalis* prepared by Luer (1975, p. 103) shows this species occurring in the eastern townships of Quebec, when he himself recognized the northern plants, previously referred to *S. vernalis*, as a different species. It is now clear that *S. vernalis* does not occur in the eastern townships of Quebec or anywhere else in Canada (based on field work and on material from northeastern herbaria). The fact that Mousley's specimens represent *S. casei* is not only obvious from his published photographs (1942, *pl.* I and II) but also from the actual examination of his specimens (AMES, DAO, MTMG). *Spiranthes casei* and *S. vernalis* appear to be allopatric.

TAXONOMIC CHARACTERS

Having summarized the literature that has plagued botanists for the past fifty years regarding the true identity of certain northeastern *Spiranthes* species, it is now appropriate to present some detailed information about *S. casei* resulting from recent morphological re-evaluation. Since there is some precedent for grouping the types of *S. × intermedia*, *S. neglecta*, and *S. cernua × S. gracilis* with *S. vernalis* (Ames, 1921; Correll, 1950), and as it facilitates comparison, these may subsequently be referred to as the "*S. vernalis* complex" (of southern New England).

The specimens of *Spiranthes vernalis*, *S. × intermedia*, *S. neglecta*, including the types, and also the specimens of the putative *S. cernua × S. gracilis* are similar to each other in appearance but differ from *S. casei* in having a light-colored, and frequently more

dense, non-glandular pubescence on the rachis. This pubescence varies from 0.1 to 0.4 mm. in length and with 20–80 hairs per square mm., the hairs frequently being about 0.1 mm. apart. In *S. casei*, the pubescence is 0.1–0.4 mm. long and much less dense with 10–30 hairs per square mm. The pubescence of *S. casei* is also more slender and always gland-tipped. Usually the capitate glandular tips, as well as from two to seven septa, are dark reddish or amber in color. The trichomes of the *S. vernalis* complex are frequently thicker and the septa are more difficult to discern. Clubbed trichomes occasionally occur but the pubescence is essentially pointed at the tip and cannot be described as glandular. In both *S. casei* and the *S. vernalis* complex, pubescence similar to that of the rachis extends onto the ovary and the outer surfaces of the basal perianth parts, but is usually less than 0.1 mm. long. Only in *S. × intermedia* and one other specimen from southeastern Massachusetts (Ames 2247) was some intermediacy in pubescence noticeable.

Similarly the lips of the type specimens of *Spiranthes × intermedia*, *S. neglecta*, *S. cernua × S. gracilis* and *S. vernalis* differ from those of the type specimen of *S. casei*, as well as *S. casei* from areas far removed from the type locality (Figure 1). In the *S. vernalis* complex the lips are narrower, have a cuneate base and somewhat smaller basal calli. The cordate bases of the relatively wider lips of *S. casei* are clearly shown in Figure 1, g-k. Moreover, the lip of *S. casei* tends to be more apically truncated and occasionally notched and the dilation tends to be more proximal. Although no attempt has been made to illustrate pubescence of the lips here (thus bases and calli size be amply illustrated), it was noticed that *S. casei* usually has the edges of the cordate base and region of the calli distinctly and often densely ciliolate, while in the types of *S. × intermedia*, *S. neglecta*, *S. cernua × S. gracilis* and *S. vernalis* this area varies from sparsely or locally ciliolate to puberulent. Although only a few flowers from the type specimens were examined in detail, over 20 flowers of each of *S. vernalis*, *S. casei* and *S. lacera* var. *gracilis* (from throughout their range) have been examined, and the floral parts represented here are characteristic.

Spiranthes casei also differs from the *S. vernalis* complex of southeastern Massachusetts in having relatively broader lateral petals (Figure 2) reflecting the characteristically more robust nature of the flowers. Specifically, *S. casei* differs from *S. × intermedia* in possessing three major veins in the lateral petals whereas *S. ×*

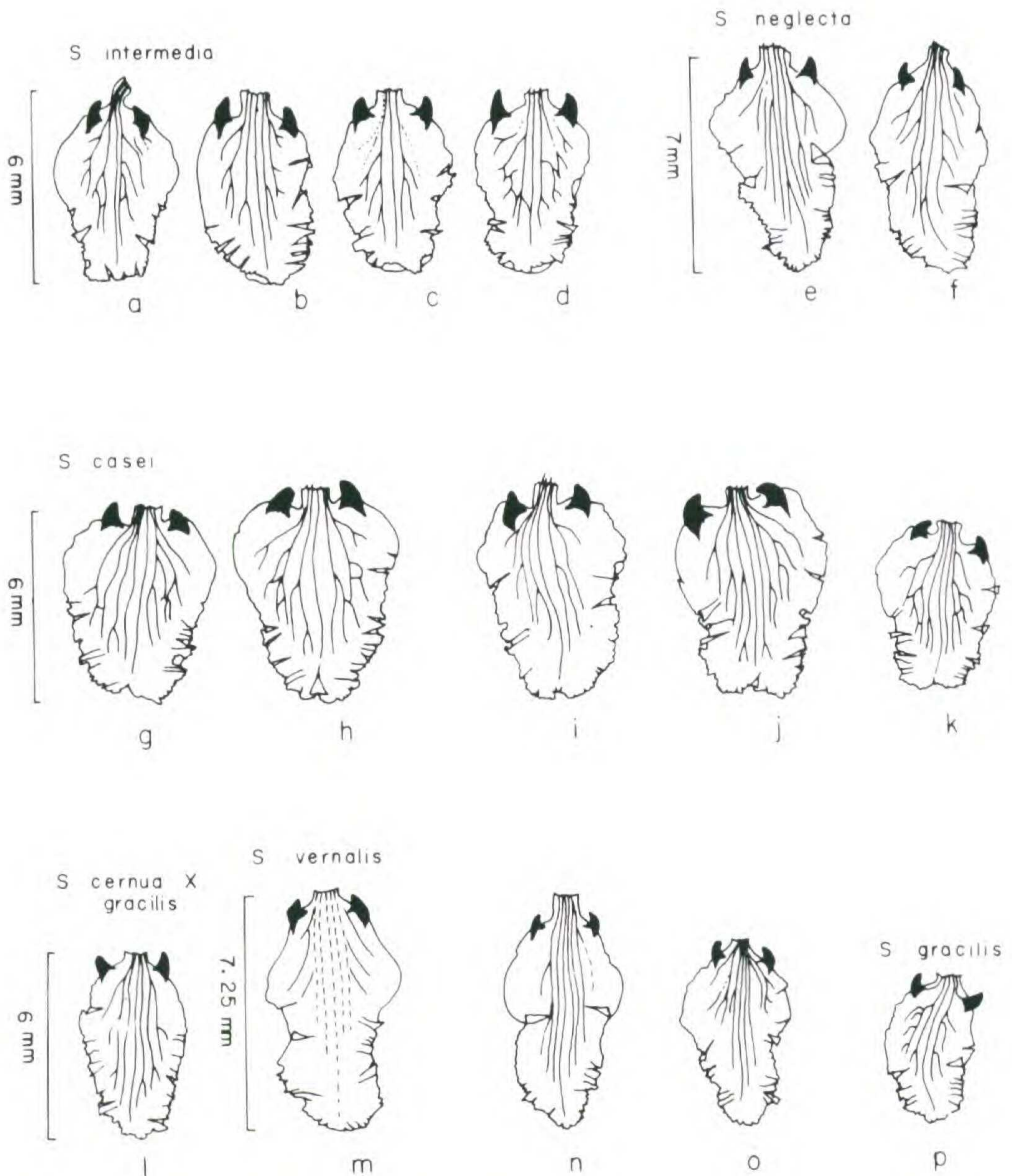


Figure 1. Camera-lucida drawings of the lips of *Spiranthes* spp. a, b, c, d, *S. intermedia* Ames, TYPE (AMES 2246); e, f, *S. neglecta* Ames, TYPE (AMES 2518); g-k, *S. casei* Catling & Cruise; g, h, TYPE (TRT 169205); i, New Hampshire (AMES 67224); j, Quebec (AMES 63778); k, Michigan, *Bob & Fassett* 9484 (WIS); l, *S. cernua* x *gracilis* Ames, TYPE (AMES 17391); m-o, *S. vernalis* Engelm & Gray; m, TYPE, redrawn from a drawing by Ames accompanying the type (AMES 82967); n, Missouri, *Palmer*, 14 June 1958 (WIS); o, Connecticut, *Eames*, 8 Aug. 1897 (WIS); p, *S. gracilis* (Bigel.) Beck., Massachusetts, *Wiegand* (WIS).

intermedia has only two or a secondary third. Interestingly, *S. lacera* var. *gracilis* usually has only two.

The robust nature of the flowers of *Spiranthes casei* is also manifest in the value of the length versus width ratio of the lateral sepals. When sepal width is plotted against sepal length (Figure 3), with the pubescence characters represented symbolically, it becomes clear that the types of *S. × intermedia*, *S. neglecta* and *S. cernua × S. gracilis* belong with *S. vernalis* and not with *S. casei*; furthermore, the types of *S. casei* fall well within the boundaries of that species, differing markedly from *S. vernalis*.

Certain other floral characters distinguish *Spiranthes casei* from *S. × intermedia*, and from the *S. vernalis* complex in general. A flower from the type of *S. × intermedia*, reconstituted with ammonium hydroxide (Figure 4) certainly resembles the relatively narrow and delicate flowers of *S. vernalis* and *S. lacera* var. *gracilis*. The dorsal perianth parts extend conspicuously beyond the lip in the flowers of *S. × intermedia* (Figure 4c) and are usually upcurved at the tip, but in *S. casei* the dorsal perianth parts barely extend beyond the lip and they are usually not upcurved (Figure 4d). Due to their narrowness, their somewhat greater divergence, and their plane of attachment, the lateral sepals in the *S. vernalis* complex frequently leave a space below the lip in lateral view, but in the robust flowers of *S. casei* no such space is apparent and less of the lip is visible (Figure 4c&d).

There is also a notable difference in the nature of the column (Figure 4a&b). In the types of *Spiranthes × intermedia*, *S. neglecta* and the specimens of the putative *S. cernua × S. gracilis*, as well as in several flowers of *S. vernalis* from widely separated localities, the column was found to be distinctly stipitate (Figure 4a) while in numerous flowers of *S. casei* examined, including the type, the column is not stipitate, but rather only slightly and gradually constricted toward the base. Although some other differences in the column structure appear to exist, it would be difficult to discuss them with certainty on the basis of reconstituted dried flowers alone.

The characteristic floral density of the spike in *Spiranthes* spp. may be expressed in quantitative terms by calculating the value for a ratio of spike length (mm.) to flower number. Since *S. casei* has a relatively more open spike, this ratio will have a relatively greater value. In Figure 5 the floral density ratio is plotted against the ratio

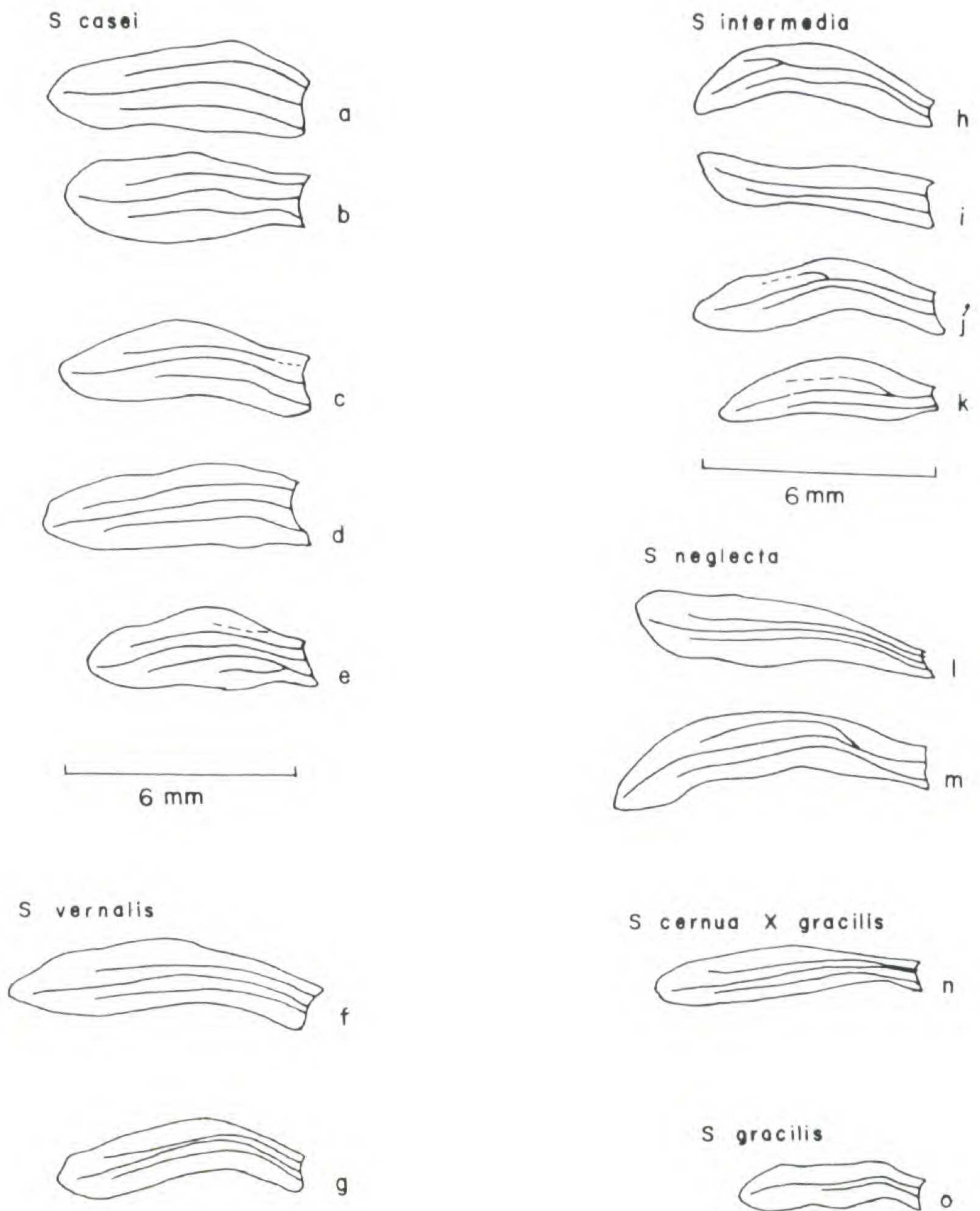


Figure 2. **Camera-lucida drawings of lateral petals of *Spiranthes* spp.** a-e, *S. casei* Catling & Cruise; a, b, TYPE (TRT 169205); c, New Hampshire (AMES 67224); d, Quebec (AMES 63778); e, Michigan, *Bob & Fassett 9484* (WIS); f, g, *S. vernalis* Engelm. & Gray; f, Missouri, *Palmer*, 14 June 1958 (WIS); g, Connecticut, *Eames*, 8 Aug. 1897 (WIS); h-k, *S. intermedia* Ames, TYPE (AMES 2246); l, m, *S. neglecta* Ames, TYPE (AMES 2518); n, *S. cernua* × *gracilis* Ames, TYPE (AMES 17391); o, *S. gracilis* (Bigel.) Beck., Massachusetts, *Wiegand* (WIS).

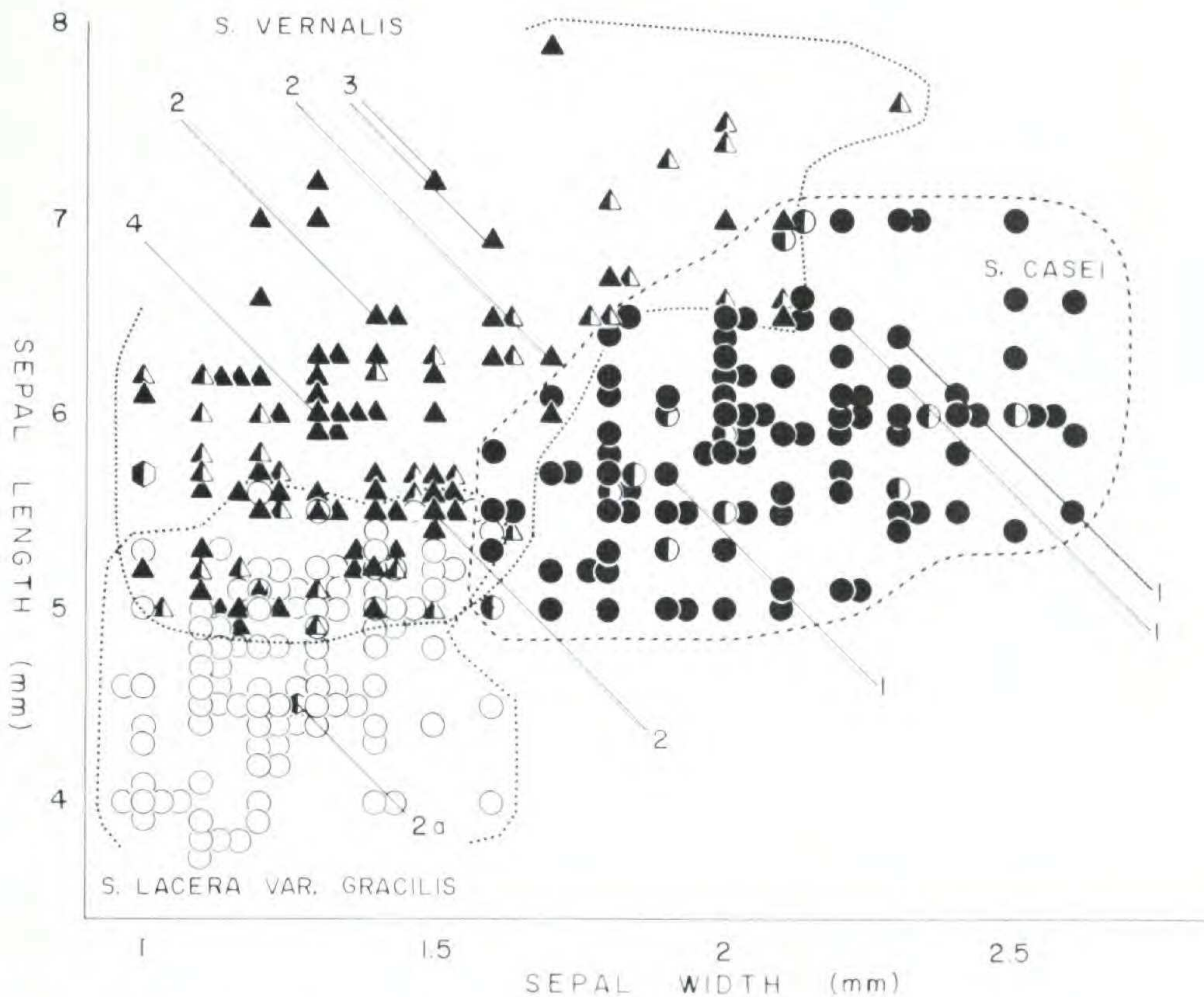


Figure 3. Sepal width plotted against sepal length for *S. lacera* var. *gracilis*, *S. vernalis*, and *S. casei*, with various symbols representing different pubescence types, and shading representing different pubescence lengths. 1, *S. casei* Catling & Cruise TYPE (TRT 169205); 2, *S. intermedia* Ames TYPE (AMES 2246); 2a, *S. intermedia* Ames COTYPE (AMES 2246); 3, *S. neglecta* Ames TYPE (AMES 2518); 4, *S. cernua* × *gracilis* Ames TYPE (AMES 17391). The triangles represent pointed non-glandular pubescence, whereas the circles indicate glandular-capitate pubescence. Intermediate pubescence is shown with a hexagonal symbol. Relative lengths of pubescence are indicated with three degrees of shading. No shading indicates pubescence 0–0.12 mm. in length, partial shading indicates 0.13–0.25 mm., and full shading indicates pubescence 0.26–0.43 mm. long.

of lateral sepal length versus lateral sepal width, again with pubescence characters represented symbolically to reduce species identification prejudice. The types of *S. × intermedia*, *S. neglecta* and *S. cernua* × *S. gracilis* again fall with *S. vernalis*, while *S. casei* and its types are altogether discrete.

This morphological re-evaluation, including type material, demonstrates that *Spiranthes casei* is quite distinct from the *S. vernalis* complex (including *S. × intermedia*) in the type of pubescence; in

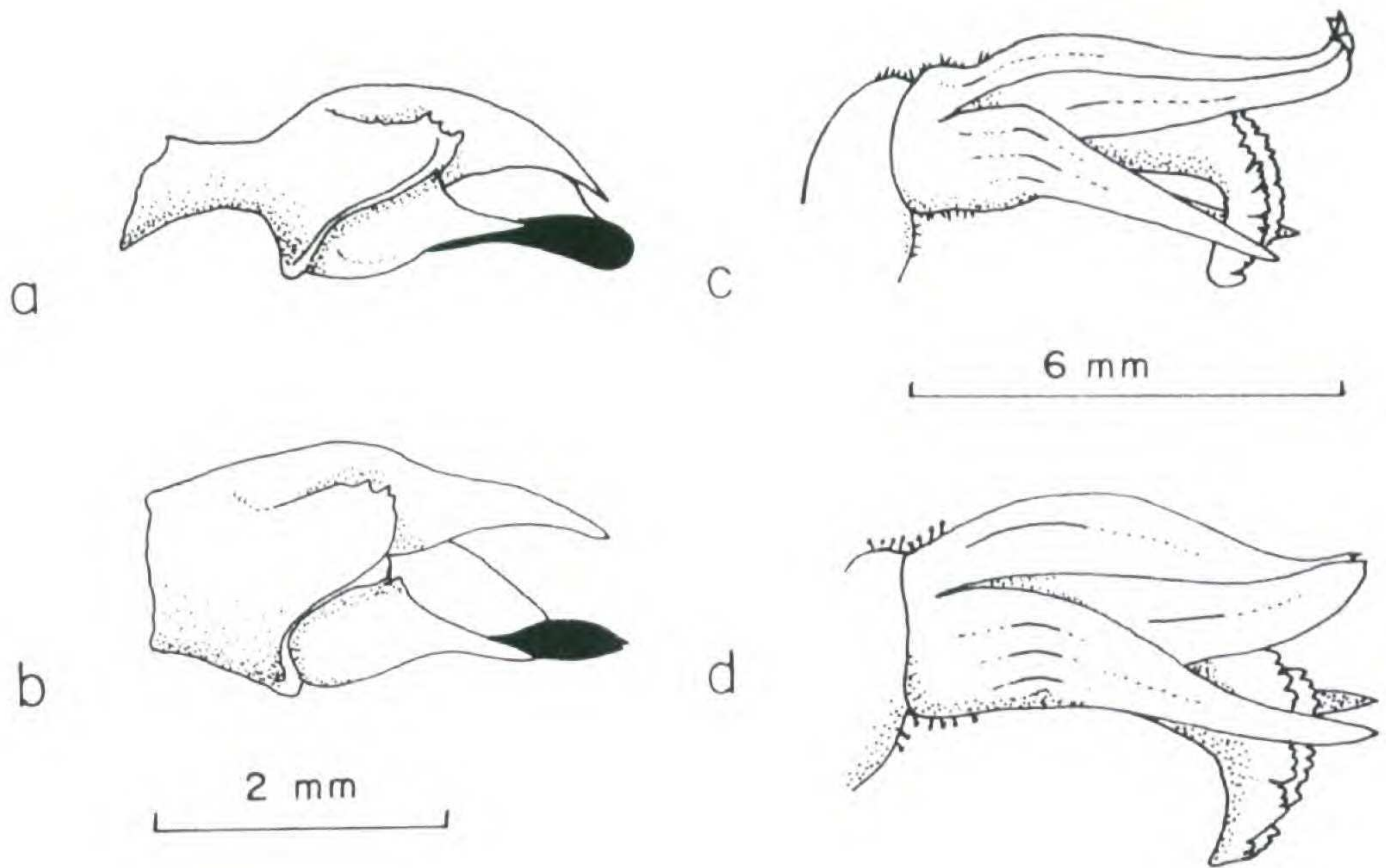


Figure 4. a,b, lateral view of column of a, *S. intermedia* Ames (AMES 2246 holotype), b, *S. casei* Catling & Cruise (AMES 63778); c,d, lateral view of flowers of c, *S. intermedia* Ames (AMES 2246 holotype), d, *S. casei* Catling & Cruise (AMES 63778).

the shape, size and venation of lateral petals; in the shape of the lateral sepals; in the morphology of the lip; in the structure of the column; in certain details of floral structure and in the floral density of the spike.

Although the types of *Spiranthes neglecta* and the specimen of the putative *S. cernua* \times *S. gracilis* appear to closely resemble *S. vernalis*, *S. \times intermedia sensu* Ames does seem to demonstrate some intermediacy between *S. vernalis* and *S. lacera* var. *gracilis* with respect to lip size, shape and major venation (Figure 1). An intermediate condition is apparent in the lateral petals, where, although some variability in shape occurs, the venation frequently involves a third secondary vein as opposed to the two veins of *S. lacera* var. *gracilis* and the characteristic three veins of *S. vernalis* (Figure 2). Intermediacy of *S. \times intermedia* is also apparent in its variability in pubescence (Figure 3), the general appearance of the flowers, the floral density of the spike (Figure 5), and notably in flower color (see above). The type specimens of *S. \times intermedia* are remarkably diverse, with one falling in the blend area of *S. vernalis* and *S. lacera*

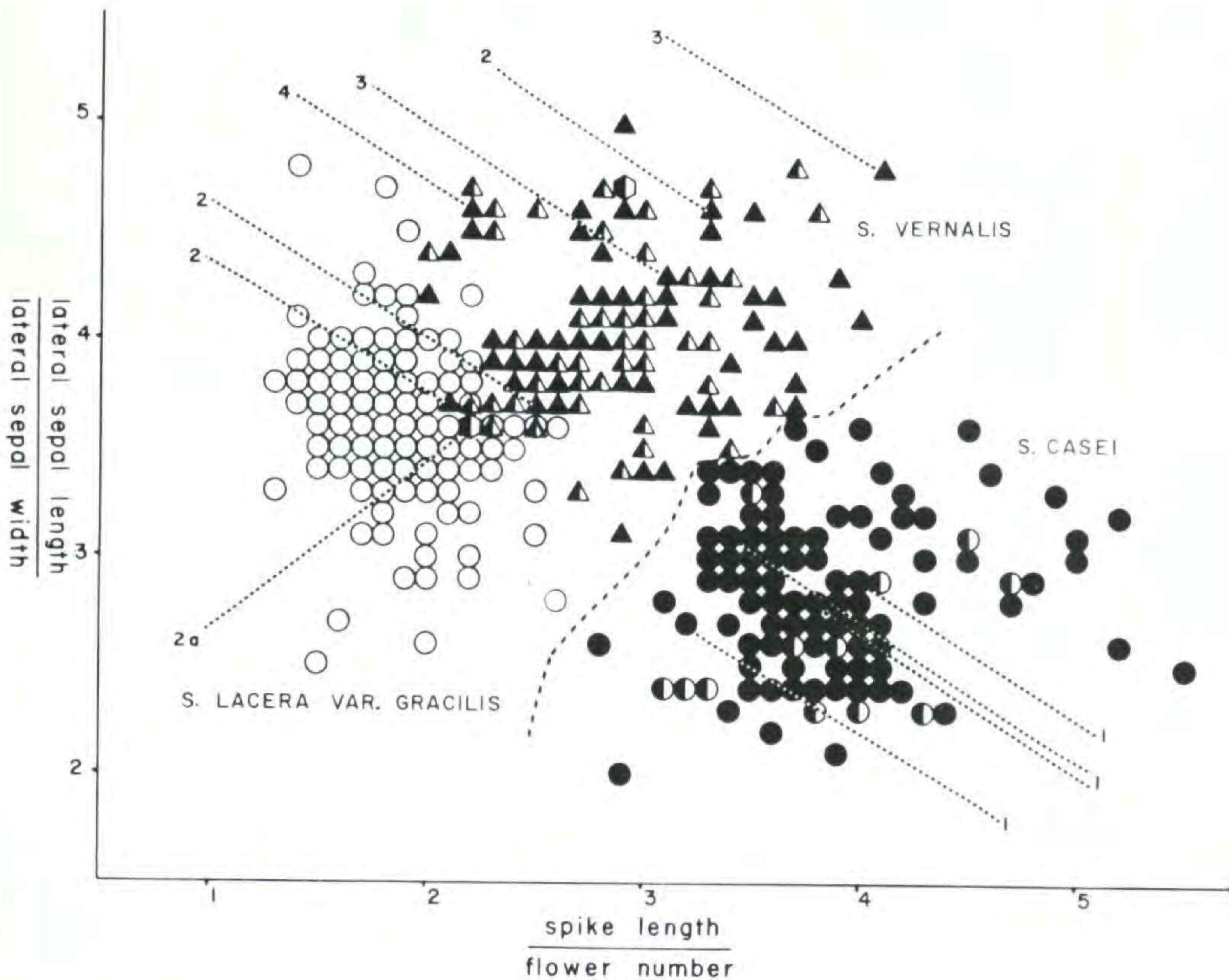


Figure 5. The ratio of lateral sepal length/lateral sepal width plotted against the ratio of spike length/flower number. Symbols and types as in Figure 3.

var. *gracilis* in both Figures 3 and 5. An isotype specimen of *S. × intermedia* with pubescence characters unlike *S. vernalis*, appears in the middle of *S. lacera* var. *gracilis* in Figure 3 and along the peripheral blend zone in Figure 5, further suggesting its possible hybrid origin.

Spiranthes × intermedia is reported to grow in close association with its putative parents, *S. vernalis* and *S. lacera* var. *gracilis*, and it also flowers at the same time (Ames, 1903; St. John, 1918). This habit is in keeping with a hybrid interpretation. Although *S. lacera* var. *gracilis* and *S. vernalis* flower simultaneously in southern New England, further to the south *S. vernalis* flowers much earlier. In New Jersey, when *S. lacera* var. *gracilis* is in anthesis in late August, *S. vernalis* has already passed flowering. The simultaneous flowering in southern New England may have led to the hybridization that created the taxonomic difficulties that prompted Ames to study this hybrid complex and resulted in his broad concept of *S. vernalis* (Ames, 1924).

Of course, it would be desirable to study this hybrid complex in the field, but unfortunately the open meadow habitats at the type localities around Easton, Mass., appear to have been largely destroyed by urban development, and also by natural succession to scrub and woodland. Perhaps 70 years ago with the forest cleared by cutting and burning, and a farming community based on pasturelands, *Spiranthes* spp. were much more frequent in the area.

Field and cytological study is certainly desirable to demonstrate further the probable hybrid nature of *S.* \times *intermedia*. The possibility of *S. cernua* contributing to the hybrid complex is also worthy of investigation.

CONCLUSIONS

Based on a critical review of existing literature and on actual re-examination of type specimens, the plants described and illustrated as *Spiranthes intermedia* Ames (*pro* hybr.) by Luer (1975) fall into synonymy with *S. casei* Catling & Cruise (1974). Reports of *S. vernalis* in the eastern townships of Quebec actually refer to *S. casei*, which has a more northern distribution and is absent from southern New England. The name *S.* \times *intermedia* should be retained for hybrids which may still occur in southern New England where *S. vernalis* and *S. lacera* var. *gracilis* occur together and flower simultaneously. *Spiranthes cernua* \times *S. gracilis* Ames and *S. neglecta* Ames, although perhaps a part of a hybrid complex, appear to be sufficiently similar to *S. vernalis* to be placed in synonymy.

ACKNOWLEDGEMENTS

I wish to extend special thanks to Dr. J. E. Cruise, University of Toronto, for his suggestions in the preparation of the manuscript and for his financial assistance through N.R.C. Grant No. A-2363. Dr. L. A. Garay of the Oakes Ames Orchid Herbarium, Harvard University, is gratefully acknowledged for making the facilities of his laboratory available for the detailed examination of type material. Dr. Garay and Mr. A. A. Reznicek are thanked for their critical reading of the manuscript. The National Research Council is acknowledged for their continuing support of biosystematic studies of northeastern *Spiranthes* through a postgraduate scholarship.

REFERENCES

- AMES, O. 1903. Natural Hybrids in *Spiranthes* and *Habenaria*. *Rhodora* **5**: 261–264, *pl.* 47.
- . 1904. *Spiranthes neglecta*. *Rhodora* **6**: 27–31, *pl.* 51.
- . 1921. Notes on New England orchids. I. *Spiranthes*. *Rhodora* **23**: 3–85, *pls.* 127–129.
- . 1924. An enumeration of the orchids of the United States and Canada. Am. Orchid Soc., Boston, 120 pp.
- CATLING, P. M. & J. E. CRUISE. 1974. *Spiranthes casei*, a new species from northeastern North America. *Rhodora*, **76**: 526–536.
- CORRELL, D. S. 1950. Native orchids of North America north of Mexico. Chronica Botanica Co., Waltham, Mass. 399 pp.
- LUER, C. A. 1975. The native orchids of the United States and Canada excluding Florida. New York Botanical Garden, New York. 361 pp.
- MOUSELY, H. 1941. Two orchids new to the Province of Quebec and the Dominion of Canada, *Spiranthes vernalis* Engelm. & Gray and *Spiranthes cernua* (L.) L. C. Rich. var. *odorata* (Nutt.) Correll. *Canadian Field-Nat.* **55**: 79–80, + 2 *pl.*
- . 1942. The spring ladies'-tresses (*Spiranthes vernalis* Engelm. & Gray) in Canada. *Canadian Field-Nat.* **56**: 1–2, + 2 *pl.*
- ST. JOHN, H. 1918. *Spiranthes* in Dover, Massachusetts. *Rhodora* **20**: 111–114.
- WHITING, R. E. & P. M. CATLING. 1971. Checklist of Ontario orchids. *Fed. Ontario Nat., Newsletter* **12**(3): 9–10.

P. M. CATLING

DEPARTMENT OF BOTANY

UNIVERSITY OF TORONTO

TORONTO, CANADA M5S 1A1